

# ESPADP Input Generator Model Adapter

## Description of Adapter

The ESPADP Input Generator constructs ESP binary-format files and datacard files that can be used as input to the Ensemble Streamflow Program Analysis and Display Program (ESPADP), an AWIPS program designed for viewing ensemble data. This will allow for ESPADP functionality to be applied to CHPS generated ensemble time series until the Graphics Generator is completed, replacing ESPADP functionality in CHPS.

The existing version of ESPADP should display binary files generated by this adapter without problems. However, if the descriptive name (or location name) and latitude and longitude of the location in CHPS are not available, then the inputs.xml will not provide this information to the model adapter, and the generated ESP binary file will not include the information. Thus, ESPADP will not display it in its default plot title (the name will be empty and the coordinates will be -999). In such a case, a new version of ESPADP has been delivered to the legacy model bin directory (Models/ohd/bin) that will attempt to find this information within the rating curves in the NWSRFS OFS database (fs5files). However, this will only work if a rating curve has been defined in the NWSRFS OFS database for the appropriate segment and data type. Please see Section 4 for more information on how to make the descriptive name, latitude, and longitude available to the ESPADP Input Generator model adapter.

## Model Parameters

The ESPADP Input Generator model adapter does not use parameters. However, dummy parameters must still be exported. The following is an acceptable parameters XML file:

```
<?xml version="1.0" encoding="UTF-8"?>
<parameters xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.wldelft.nl/fews/PI" xsi:schemaLoca
tion="http://www.wldelft.nl/fews/PI/pi_modelparameters.xsd" version="1.5">
  <group id="default">
    <parameter id="DUMMY">
      <stringValue>DUMMY</stringValue>
    </parameter>
  </group>
</parameters>
```

Alternatively, a parameter file for another module can be exported; since the parameters will not be used, it does not matter what parameters are in the exported parameters XML file.

## Model States

The ESPADP Input Generator model adapter does not use states.

## Model Time Series

### *When Not Generating a Historical Simulation (HS) File*

When generating a non-HS output file (i.e., CS, ER\*, or datacard), the ESPADP Input Generator model adapter requires one or more ensemble time series:

Time Series Type	Internal Model Units	Time Step	Input or Output	Missing Values Allowed	Required [Yes or No]
Ensemble Time Series	-	any	Input	No	Yes

The information in the header of the ensemble will be used to build the header of the ESP binary file or datacard file built, including location id, parameter id (data type in NWSRFS), time step, long name (descriptive name), etc. If the location id or parameter id do not match what ESPADP expects in the file, then an id-map should be used to convert the identifiers to those that ESPADP expects.

The ESPADP Input Generator algorithm assumes two time series within the exported inputs.xml pi-timeseries file are for the same ensemble if their location ids, parameter ids, and time steps match. Therefore, it is reasonable for the ESPADP Input Generator to generate all ensemble forecasts for any number of location ids, parameter ids, and time steps in a single configured run (within limitations of available computer memory). However, each configured run should be for only one ensemble id.

### *When Generating a Historical Simulation (HS) File*

When generating an HS output file, the ESPADP Input Generator model adapter requires two time series per ensemble file to generate:

Time Series Type	Internal Model Units	Time Step	Input or Output	Missing Values Allowed	Required [Yes or No]
Template Time Series	-	any	Input	Yes	Yes
Historical/Calibration Time Series	-	any	Input	No	Yes

The template time series specifies identifying information (location id, parameter id) and a forecasting window for the HS file that is to be generated. Missing values are allowed in the template time series, since only the header information in this time series is used, not the data. The historical, or calibration run, time series provides the data that is to be converted by the ESPADP Input Generator into an HS file format.

The ESPADP Input Generator algorithm assumes two time series within the exported inputs.xml pi-timeseries file are to be used to generate the same ensemble file if their location id and time step match. Furthermore, the first time series found is assumed to be the template time series and the second is assumed to be the historical/calibration time series; if the number of time series found for a location id and time step is not exactly 2, the adapter will not generate the corresponding file. Thus, it is reasonable for the Input Generator to generate all ensemble forecasts for any number of location ids and time steps in a single configured run. However, each configured run should generate files of only one parameter id (that specified in the template time series) per location and time step.

### ***Latitude, Longitude, and Descriptive Name***

The latitude, longitude, and descriptive name for a segment are displayed in the default plot title for plots generated by the ESPADP. This information must be provided in the header of the ESP binary file. As such, the information must be available within the time series provided in the inputs.xml file.

In order for the information to be exported with the time series, the general section of the module configuration file must set the version number to 1.8 or above:

```
<general>
...
<piVersion>1.8</piVersion>
...
</general>
```

Furthermore, the Locations.xml must define the descriptive name as the “name” for the location, as well as the location’s coordinates. For example:

```
<location id="HGLO2" name="HUGO 7E - DAM (DCP)">
  <description>HUGO 7E - DAM</description>
  <shortName>HGLO2</shortName>
  <x>-95.3802777778</x>
  <y>34.0116666667</y>
  <z>142.0368</z>
</location>
```

(the descriptive name and coordinates are highlighted). The descriptive name will appear in the inputs.xml file as the stationName within a time series header.

If the latitude, longitude, and descriptive name are not provided in the inputs.xml, a new version of ESPADP can be used that will get the information from the OFS database; see Section 1.

## Notes about configuring Model in FEWS workflow

The ESPADP Input Generator does not generate any output time series. Hence, no import activity should be performed.

The ESPADP Input Generator model adapter uses specific properties defined within the run\_info.xml file and configured within the exportRunFileActivity in a module configuration file. The following properties are used:

Property Name	Description
firstYearToUse	<p>Defines the year to assign to the first ensemble member.</p> <p>If not specified, then the first ensemble member will be assigned to a year based on its ensemble member index if that index is not less than 1900, or the current year minus the ensemble size otherwise.</p>
generatedEnsembleType	<p>Defines the type of ensemble, specifying the extension to use in the default generated file name. It must be one of “CS”, “HS”, “ER1”, “ER2D”, “ER2S”, or “OBS”. If specified, this must be consistent with the generatedFileType property (see generatedFileType, below).</p> <p>If not specified, then the extension on the default file name will be CS if the generatedFileType is ESPBinary and OBS if it is Datacard.</p>
generatedFileName	<p>The name of the file to generate. If specified, then all generated files will have this name, making it only appropriate to use if one file is being generated.</p> <p>If not specified, the default file name will be based on the input ensemble time series information (see below).</p> <p>An optional property “genFileNameWithT0Flag” can be set as “true” in run_info.xml to save the generated filename with T0 date information. This prevents the generated file overwritten in the batch run. e.g HUNP1ESP.HUNP1ESP.QINE.06.CS.2003-09-02. This flag applies to all kinds of generatedFileType. The default value for this flag is set as “false”.</p>
generatedFileType	<p>Either “Datacard” or “ESPBinary”. If the</p>

	<p>generatedEnsembleType is specified, then it must be consistent with the generatedFileType. That is, if generatedEnsembleType is OBS, then generatedFileType must be Datacard. Otherwise, it must be ESPBinary.</p> <p>If not specified, ESPBinary is assumed.</p>
outputDirectory	<p>Specifies the directory where all generated files will be placed.</p> <p>This property is required and must be specified in the run information.</p>
segmentIdFor.<location id>	<p>Specifies a segment id to use when constructing the default name of a generated file for the given location id. Note that the location id is that which is in the exported time series file (after id-mapping, if applicable).</p> <p>If not specified, the segment id is assumed to be identical to the location id.</p>

Based on the properties above and the input time series, the adapter creates either a binary or datacard file as follows:

- If generatedEnsembleType is HS, then a historical simulation binary file is generated.
- If generatedFileType is ESPBinary, then:
  - i. If the generatedFileName is given, generate an ESP binary file with that name. If the path is not specified in the name, it will be placed in the outputDirectory.
  - ii. If the generatedFileName is not given, generate an ESP binary file with the default name (see below) and place it in the outputDirectory.
- If generatedFileType is “Datacard”, then:
  - i. If the generatedFileName is given, generate a datacard file with that name. If the path is not specified in the name, it will be placed in the outputDirectory.
  - ii. If the generatedFileName is not given, generate a .OBS datacard file with the default name and place it in the outputDirectory.

### ***Default Generated File Names***

The default file name of a generated file is based on the time series information exported to the model, after applying any id-mapping:

<segment id>.<location id>.<parameter id>.<time step>.<ensemble type>

If the location id or parameter id in the exported time series do not match what ESPADP expects in the file name (time series id and data type, respectively), then an id-map should be defined to convert the identifiers to those that ESPADP does expect.

The <segment id> is either the location id or the value of the property “segmentIdFor.<location id>” defined for the location. It is only necessary to define a segmentIdFor property if the NWSRFS time series id is not identical to the segment id (i.e., the first two components of the name of the ESP binary file to generate are not identical). For example,

```
<string key="segmentIdFor.DWRI1" value="DWRI1" />
```

maps the location id “DWRI1” to segment id “DWRI1”, so that the default name of a generated file will use “DWRI1” as the first component; for example:

DWRI1.DWRI1.QINE.06.CS.

### *Example exportRunFileActivity Configuration*

The following is an example of an exportRunFileActivity configuration in which all properties are defined (the ESPADP Input Generator specific properties are **bolded**):

```
<exportRunFileActivity>
  <exportFile>%ROOT_DIR%/run_info.xml</exportFile>
  <properties>
    <string key="model"
value="ohd.hseb.ensutilities.espadpingen.ESPADPInputGeneratorModelDriver" />
    <string key="legacyLocation" value="$OHDBINDIR$" />
    <int key="printDebugEnabled" value="0" />
    <string key="outputDirectory" value="$ESPTSDIR$" />
    <string key="generatedFileName" value="NFNW1.NFNW1.QINE.06.CS" />
    <string key="generatedEnsembleType" value="CS" />
    <string key="generatedFileType" value="ESPBinary" />
    <int key="firstYearToUse" value="1949" />
    <string key="segmentIdFor.NFNW1" value="NFNW1" />
  </properties>
</exportRunFileActivity>
```

If the ensemble time series exported to inputs.xml have location id NFNW1, parameter id QINE, time step 6 hours, and the ensemble member indices correspond to years, then the above example configuration can be simplified to use default values, as shown below:

```
<exportRunFileActivity>
  <exportFile>%ROOT_DIR%/run_info.xml</exportFile>
  <properties>
```

```

    <string key="model"
value="ohd.hseb.ensutilities.espadpingen.ESPADPInputGeneratorModelDriver" />
    <string key="legacyLocation" value="$OHDBINDIR$" />
    <int key="printDebugInfo" value="0" />
    <string key="outputDirectory" value="$ESPTSDIR$" />
  </properties>
</exportRunFileActivity>

```

### ***Producing .HS ESP files.***

1. Because of the large quantity of data, we had to set up very specific LocationSets and ModuleInstanceSets to be used in the generation of ESP products. If there was not a one-to-one correlation between the two, we ran into memory problems.
2. Two time series are needed for the ESPADP\_InputGenerator for HS files:
  - a. A Template Timeseries  
We used the ESP ensemble created from the general ESP run but only used one year of the timeseries since it is a template (i.e., ensembleIndexRange starts and ends with 1961.)
  - b. A Calibration Timeseries  
We created a workflow (xxxx\_HS\_Forecast) which runs the forecast group segments for the length of the datacards and produces timeseries with a single ensembleId of "HS". The tricky part is getting the preprocessors set up to run this workflow. This workflow only needs to be run once to create the calibration timeseries.

Another difficulty is that one cannot specify a specific start date for the calibration timeseries, so we put in a very long start time and the InputGenerator will just output "-999" for dates before the start of the datacard period of record.

3. Once the Calibration timeseries has been computed, we simply run the ESPADP\_InputGenerator\_HS module after the ESPADP\_InputGenerator\_CS module.

### ***Recommended Module Configuration***

ESPADP Input Generator modules should be configured like all other OHD Modules

1. Use a pair of input timeseries files (FastInfoSet and binary) for better performance

```

.....
<exportTimeSeriesActivity>
  <exportFile>inputs.fi</exportFile>
  <exportBinFile>true</exportBinFile>
.....

```

2. Use %TEMP\_DIR% for <rootDir> to make ESPADP Input Generator Modules consistent with other OHD modules. This change also makes it possible to run simultaneous ESPADP Input Generator Modules

Examples:

Configuration File

[ConfigFiles\LowerSacramento\\_BlendTS\\_Forecast.xml](#)

Parameter File

[ParameterFiles\LowerSacramento\\_ESPADP\\_InputGenerator\\_CS.xml](#)

## **FEWS Adapter Used**

The ESPADP Input Generator model adapter uses the OHDFewsadapter to communicate. Information about this adapter can be found at [OHDFewsadapter](#).